Lassonde School of Engineering
Department of Earth and Space Science and Engineering
Geomatics Engineering

LE/ESSE 4650 – Hydrography
Winter 2022

LAB # 6: Processing of Multi Beam Echo-Sounding Data (100)
Part C: Generation and Export of Bathymetric Products

Assigned: **March 18, 2022**
Due: **March 29, 2022**

Objective:
The objective of this lab is to acquaint students with processing of data from a multibeam echosounder using the CARIS HIPS and SIPS application software.

IMPORTANT NOTE: The license for using the provided CARIS software and the provided datasets are only for the purpose of this lab assignment. Do not use or distribute any of the software, data or any related information outside this course.

SUBMISSION OF LAB TECHNICAL REPORT AND REQUIREMENTS:

1. Submit a full detailed report to demonstrate and explain your understanding of the steps involved in processing the echo-sounding data. Additionally, you may utilize screenshots to show your results.
2. Provide a workflow chart of the steps undertaken to process the echo-sounding data.
3. Throughout this document, there are several requirements for lab submission. These are highlighted in **red** under the heading '**SUBMIT'**. Ensure these are requirements are also met and submitted along with your lab report.

The processing of multi beam data will be performed in three parts.

Part A: Data import and Project Creation
Part B: Generation of Georeferenced Bathymetry
Part C: Generation and Export of Bathymetric Products

Data and associated information:

You are provided with the following dataset:
- *Teledyne RESON SeaBat 7125, Multibeam Sonar, 512 beams.*
- *Vessel: FA_2807_Reson7125*
- *Date Collected: March 31, 2011 and April 01, 2011 (JD 2011-090 and 2011-091).*

Preprocess and Background data (Relevant Ancillary Data)

i. **Raw Data files for Conversion – Hypack Data** (*.RAW or *.HSX)
ii. **Background -** (*.KAP and *.000)
iii. **Applanix Ancillary Data**
- **Delayed Heave:** *2011_090_2807.000 and 2011_091_2807.000*
- **Navigation =** *2011_090_2807.sbet and 2011_091_2807.sbet*
- **Real Time Uncertainty data =** *2011_090_2807.smrmsg and 2011_091_2807.smrmsg*
- **SVP data** = *H12281_2807.svp*
- **Tide data:** *Seattle_9447130_20110318_20110502.tid*

Rawness of data

- Data are roll-compensated only, but not corrected for any other vessel motion.
- Offsets for navigation lever arms are compensated for in the POS/MV.
- Travel time and angle information is available.

Positioning information

- Data in geographic coordinates.
- **CRS** Pick **NAD83 / UTM zone 10N EPSG:26910**

Part C: Generation and Export of Bathymetric Products consists of the following steps:

1) Surface creation
- Single resolution surface
- CUBE surface generation
- 2D and 3D data visualization
- Spatial metadata

2) Bathymetric product generation
- Surface finalization
- Chart generalization

3) Export of bathymetric products
- Surface raster soundings to image format

Task C1: Surface creation

Use the georeferenced sounding data and the associated uncertainty values to create a gridded surface to represent the survey data. Various algorithms can be used to created the gridded representation of the georeferenced bathymetric data.

HIPS supports the ability to create four different types of Single Resolution surfaces. The surface types use different weighting algorithms or selections to produce grids of the bathymetric data. All four surface types will produce a smooth surface that retains the sonar

resolution.

Task C1.1: Generate a single resolution surface – Use of CUBE surface

Single resolution surface has the same resolution across the entire coverage area. For this exercise the CUBE (Combined Uncertainty and Bathymetry Estimator) Surface generator will be used (page 119). The CUBE surface is also a powerful, semi-automated cleaning tool that can be used to increase processing efficiency

*** Before generating a CUBE surface, all lines to be included must be Georeferenced with TPU computed. Follow the procedure in Pages123-126 (Exercise 37).

Click the **New Regular Gridded Surface** icon, or **Tools > Coverages > Grid > Single Resolution Surface**
Make sure to save file as **CUBE_1** in the …**Coverages** folder (Create Coverages folder).

Deliverable C1 (10): Plot the surface and make a screen caption. What do the colours represent?

Task C1.2: Set the CUBE Surface properties

The CUBE surface can be shaded to assist in feature recognition. Shading and other image manipulation tools can be found in the Properties window. This window can be used to manipulate the display of the various layers listed in the Layers window.

Highlight the layer **CUBE_1m** on the **Layers** window and
Follow the procedures in Pages 127-130 up to Colors (Exercise 38).

Deliverable C2 (20): Use the **expression builder** (page 129) to select the following depth ranges:

i. depth <=30m
ii. depths between 45m and 55m

Use screen caption to show your results for both depths.

Task C1.3: Display Surface and Legend

Explore various modes of data visualization (layer transparency and draping). Follow the procedure on page 135.

Deliverable C3 (15): Show the survey lines can be viewed through the semi-transparent surface (Page 135) with transparency 50.

i. Show the drape along with the survey lines as described in Page 135 (Chose Vertical exaggerations of 1.0 and 5.0 and provide screen shots)
ii. Generate the depth map and the colour depth legend (Page 138).

Task C1.4: Display project's metadata

Generate a portion of the project's metadata

Deliverable C4 (6): Provide a caption of the Project metadata. Use the Properties window (page 139).

Task C1.5: 3D and 2D Displays

Displaying the project data in 2D and 3D is a useful tool for data visualization, selection and error detection.

Deliverable C5 (10): Provide 2D and 3D display screenshots of your CUBE_1m surface and the available background layers (Exercise 61, page 205).

Task C2: Bathymetric products

Post processing options for creating various products including the finalization of the seafloor surface

Task C2.1: Surface Finalization

Surface finalization is the completion of the seafloor surface with any additional data, for example adding some designated soundings.

Deliverable C6 (12): Follow the steps of Exercise 68 (Page 231-232), keep the designated soundings checked. Provide the snapshot of your entire project with all windows.

Task C2.2: Chart generalization - Sounding Selection

It is impossible to display all soundings produced by a multibeam survey on a chart and maintain legibility. The displayed soundings depend on chart scale and purpose.

Deliverable C7 (12): Generate the selected soundings for scale 1:10000. Follow the steps of Exercise 75 (Page 249-252), keep the designated soundings unchecked. Provide the snapshot with selected soundings displayed.

Task C3: Data Export

Export of generated georeferenced bathymetric HIPS data to various formats to serve several other purposes.

Task C3.1: Export Bathymetric Surface Raster to Image format

Deliverable C8 (15): Export the CUBE_1m layer to GeoTIFF image format. Follow the steps

of Exercise 79 (p. 262 -263). Format: Export raster to GeoTIFF, Check TFW option. Import the generated GeoTiff file in a GIS or image processing software.
- Provide a screen caption of the imported image layer
- What are the values of the pixel elements?
- Generate contours with a 5m contour interval. Label the contours.
- Generate a west-east seafloor profile at location around Y= 5,270,800 m.